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I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

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Signed J Evans.

Dated 23 November 2004

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P01/7700 0.00-0408653.4 ACCOUNT CHA

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office
Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference — RH/DAS/SEB/P/76255.GB/B

2. Patent application number *(The Patent Office will fill in this part)* — 0408653.4 — 19 APR 2004

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

MELEXIS NV
Microelectronic Integrated Systems
Rozendaalstraat 12
B-8900 Ieper
Belgium

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — Belgium Corporation

8351702001

4. Title of the invention — OPTICAL DATA TRANSCEIVERS AND METHODS OF MANUFACTURING THEREOF

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

WILSON GUNN SKERRETT
CHARLES HOUSE
148/9 GREAT CHARLES STREET
BIRMINGHAM B3 3HT
UNITED KINGDOM

Patents ADP number *(if you know it)* — 7710734001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor; or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

a)

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	9
Claim (s)	
Abstract	
Drawing (s)	2 only 8

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature: Wilson Gunn Date: 19 April 2004

12. Name and daytime telephone number of person to contact in the United Kingdom: Mr D Slattery 0121 236 1038

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.*

b) Write your answers in capital letters using black ink or type.

OPTICAL DATA TRANSCEIVERS AND METHODS OF MANUFACTURING THEREOF

The present invention relates to optical data transmission systems and in particular to optical data transceivers and methods of manufacture thereof.

Optical data transmission systems use light to carry digital data along fibre optic cables. The light is generated by a first transceiver, coupled to the fibre, and travels along the fibre to its far end whereupon it is incident upon a second transceiver. The first transceiver acts to convert electrical signals into optical signals and the second transceiver acts to convert the optical signals back into electrical signals. This process may of course be reversed, with signals being sent from the second transceiver to the first transceiver, if desired.

Each transceiver has an optically active element or elements typically the optically active elements are a light emitting means and a light sensing means. It is however possible, if data transmission is required in a single direction only, that transceivers may be adapted only to emit light or to sense light i.e. to have a single optically active element being either a light emitting means or a light sensing means as appropriate. In this application, the term transceiver is used to encompass all three possibilities.

Conventionally, optical transceivers are packaged in a protective housing into which an optical fibre may be inserted and releaseably retained. To allow the fibre to be inserted and retained, an opening is provided in the housing, said opening being of a cross-section corresponding to the cross-section of the optical fibre and extending

from the surface of the housing to the light emitting and or light sensing means of the transceiver. As the cross-section of the optic fibre is typically greater than that of the light sensing or emitting means, a proportion of the light emitted by the light emitting means does not travel along the optic fibre and similarly a proportion of the light that does travel along the fibre is not incident upon the light sensing means. These losses reduce the effective intensity of the transmitted data signals and hence increase the Bit Error Rate, and reduce the efficiency, the sensitivity, data rate, and maximum communication range of the signal from their optimum values.

One way to combat these losses is to increase the intensity of the emitted signal. There are however legal limits for the maximum output signal intensity imposed to protect the vision of any person working with or using such devices. As a result the losses cannot be fully compensated for.

It is therefore an object of the present invention to provide a method of packaging an optical data transceiver that overcomes or alleviates some or all of the above problems.

According to a first aspect of the present invention there is provided a method of packaging an optical data transceiver comprising the following steps: providing an optical data transceiver, the optical data transceiver having at least one optically active element mounting reflector means on said optical data transceiver, said

compound on to the surface of said optical data transceiver such that only the reflector means and said optically active elements are left uncovered.

In this manner, a packaged optical transceiver may be provided wherein the losses of transmitted optical signals are reduced and hence the efficiency, the sensitivity, data rate, Bit Error Rate, and maximum communication range of the data signals are improved.

In one preferred embodiment, the optical transceiver is an optical transceiver of the type comprising two optically active elements, a light emitting means and a light sensing means. In an alternative preferred embodiment, the optical transceiver is an optical transceiver of the type comprising a single optically active element being a light emitting means. In a further alternative preferred embodiment, the optical transceiver is an optical transceiver of the type comprising a single optically active element being a light sensing means.

In a particularly preferred embodiment, the optical transceiver is an optical transceiver of the type comprising three optically active elements: a light emitting means operable to emit light in response to received electrical signals; a mounting means suitable for retaining an end of an optical fibre in position adjacent to said light emitting means; a first light sensing means operable to detect light emitted by the light emitting means and reflected from the end of said optical fibre, said first light sensing means being operable to output a signal indicative of the intensity of the reflected light; a second light sensing means operable to detect light incident upon said transceiver unit from an external source via said optical fibre and output

electrical signals in response thereto; and control means operable to vary the intensity of the light emitted by the light emitting means in response to the output of the first light sensing means. In such embodiments said optical transceiver unit is adapted to transmit light of a first wavelength and to receive light of a second wavelength. Furthermore said light emitting means is adapted to emit light of a first wavelength and said first light sensing means is adapted such that it detects substantially only light of said first wavelength by means of a filter, an interference coating or otherwise. Said second light sensing device may be an independent light sensing device or may be a portion of the first light sensing means operable to provide a distinguishable signal and which is adapted such that it detects substantially only light of said second wavelength by means of a filter, an interference coating or otherwise.

Preferably, the optic fibre is a plastic optic fibre (POF) or a polymer cladded silica fibre (PCS).

Preferably, said optical transceiver comprises an integrated circuit incorporating said optically active elements; and a substrate, said integrated circuit being mounted on and electrically connected to said substrate. Preferably, bond pads are provided on said substrate by means of which connections may be made from said integrated circuit to external circuitry.

The optically active elements may be implemented on a single integrated

elements may be implemented on a single integrated circuit as is convenient, required or desired.

Preferably, said optically active elements are connected to said substrate and bond pads are provided on said substrate allowing said optical transceiver to be connected to external circuitry. In some applications, said substrate may be mounted on a second substrate and external connections may be provided by vias in said first substrate.

Preferably a gel blob is applied to said optically active elements. Most preferably, said gel blob is applied so as to form a lens to assist said reflector means in directing light from said optic fibre to said optically active elements and to direct light from said optically active elements to said optic fibre.

The present invention may be adapted for use in any optical data transmission system or any optical data link. By use of appropriate combinations of transmitter units according to the first aspect of the present invention and transceiver units according to the second aspect of the present invention, duplex, half duplex and simplex links may be provided as appropriate or as desired.

One particular use of optical data transmission systems is in vehicular or automotive control or entertainment systems such as those operating to the MOST standard. Another application for such data transmission systems is for use in transmitting data between a digital imaging device and an image processing means such as those used in various automotive applications including lane following and parking assist.

According to a second aspect of the present invention there is provided a packaged optical data transceiver manufactured in accordance with the first aspect of the present invention.

The optical transceiver unit according to the second aspect of the present invention may incorporate any or all of the features described in relation to the first aspect of the invention as appropriate.

In order that the invention is more clearly understood, it will now be described further herein, by way of example only and with reference to the following drawings in which:

Figure 1 is a plan view of an optical data transceiver; and

Figure 2 is a cross-sectional view of a packaged optical data transceiver according to the present invention.

Referring now to figure 1, an optical data transceiver 100 comprises an integrated circuit 101 upon which is implemented second light sensing means 104, light emitting means 105 and first light sensing means 106, a mounting and reflecting means 102 and bond pads 107, said bond pads being electrically connected to said integrated circuit 101.

The mounting and reflecting means 102 is arranged to direct light emitted by

to the light emitting means 105 and the first and second light sensing means 106, 104. The mounting and reflecting means 102 is mounted on to the integrated circuit 101 by adhesive 206. In order to direct light from the light emitting means 105 into the optical fibre 207, the mounting and reflecting means 102 has a curved inner surface which is adapted to reflect a large proportion of incident light. The surface may be adapted to reflect light by being polished, metallised or covered with a reflective coating. To improve reflective performance if the surface is polished, the whole mounting and reflecting means 102 may be formed from white material.

Referring now to figure 2, the integrated circuit 101 is mounted on a substrate 205. The substrate 205 is provided with bond pads 209 and connection pads 210. Connections are made by way of wires (or any other suitable means) between the bond pads 107 on the integrated circuit 101 and the bond pads 209 on the substrate. The bond pads on the substrate 205 are connected to further connection pads 210 by vias through said second substrate 205 by means of which the optical transceiver 100 may be connected to external circuitry.

The optical transceiver is packaged by taking the integrated circuit 101 and attached light emitting means 105, and mounting them on said substrate 205. Before packaging, said reflector means 102 is mounted on said integrated circuit 101, said reflector means being aligned so as to reflect light from said light emitting means into said optic fibre 207 and to reflect light from said optic fibre onto said light sensing means 106, 104.

Once the reflector means 102 is in position, a blob of gel 110 is applied to the optically active elements. The blob of gel 110 may be amorphous or may be shaped so as to form a lens and accentuate the effect of the reflector means 102. A potting compound 111 is then dispensed onto the surface of the integrated circuit 101, and substrate 205 so as to cover their upper surfaces except that portion upon which the reflector means 102 sits. The potting compound 111 provides protection for all the components of the optical transceiver whilst leaving an opening through which an optical fibre 207 may be inserted to allow light to be directed to said light sensing means 104 and directed away from said light emitting means 105. The potting compound is in a fluid state when applied to the substrates 101, 205 and as such the surface tension of the potting compound before it sets results in the curved ends 112 of the package.

The gel blob provides protection for the optically active elements during and after potting. It is also possible that, the gel blob 110 may be added after potting or may be omitted altogether, if desired. The gel may be any suitable transparent compound such as a transparent epoxy or a silica based gel. The gel blob may be formed to any desired shape by use of any suitable method.

It is of course obvious to the skilled man that such a transceiver 100 may be a transceiver with light emitting means only or with light sensing means only or with both in addition to the embodiment described herein comprising light emitting means

Often optical data transmission systems use optical fibres 207 terminated by a ferrule. In order to comply with such systems, the packaged transceiver may be adapted to have a ferrule receiving means fitted thereto.

It is of course to be understood that the invention is not to be limited to the details of the above embodiment which is described by way of example only.

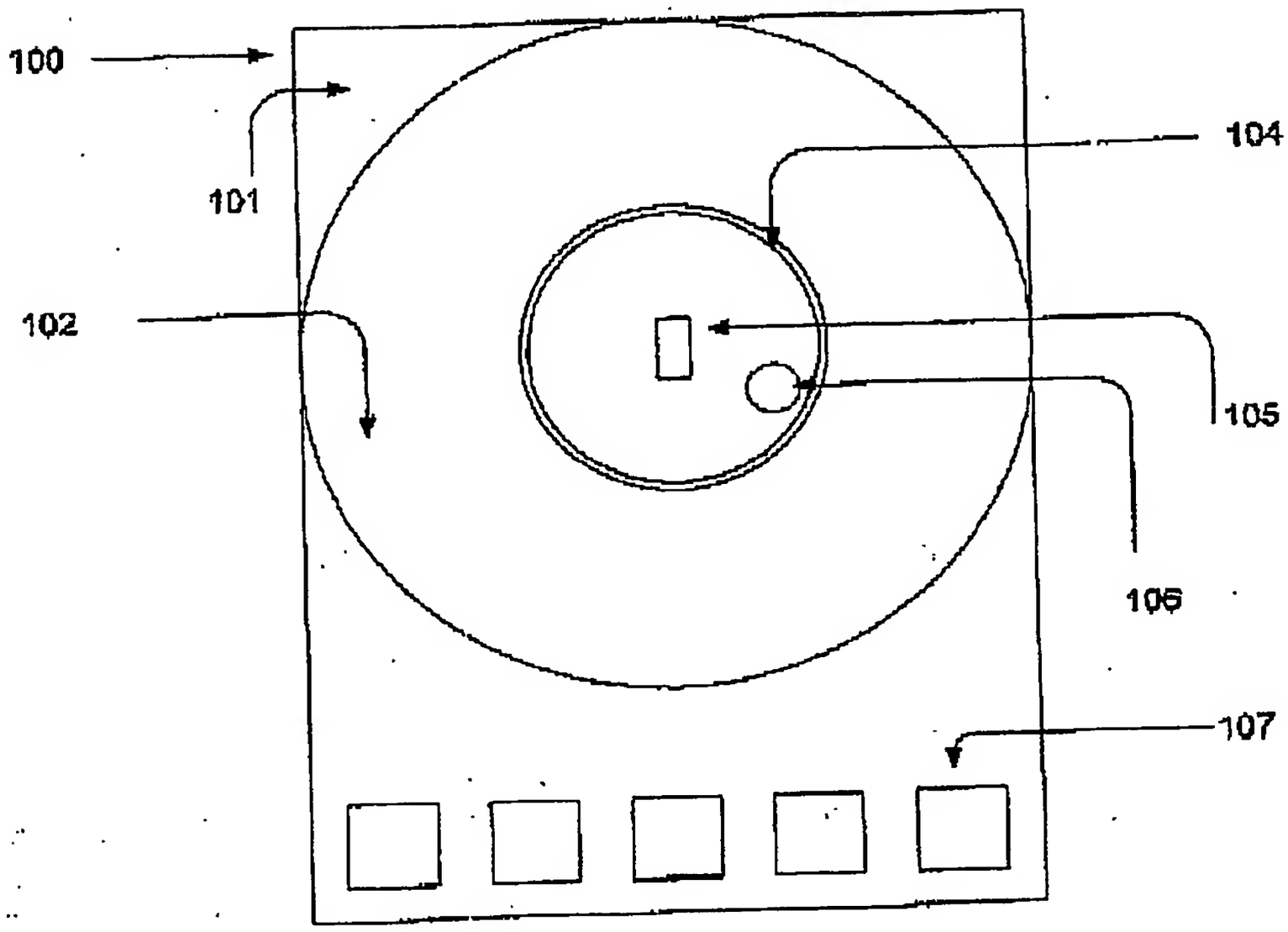

Figure 1

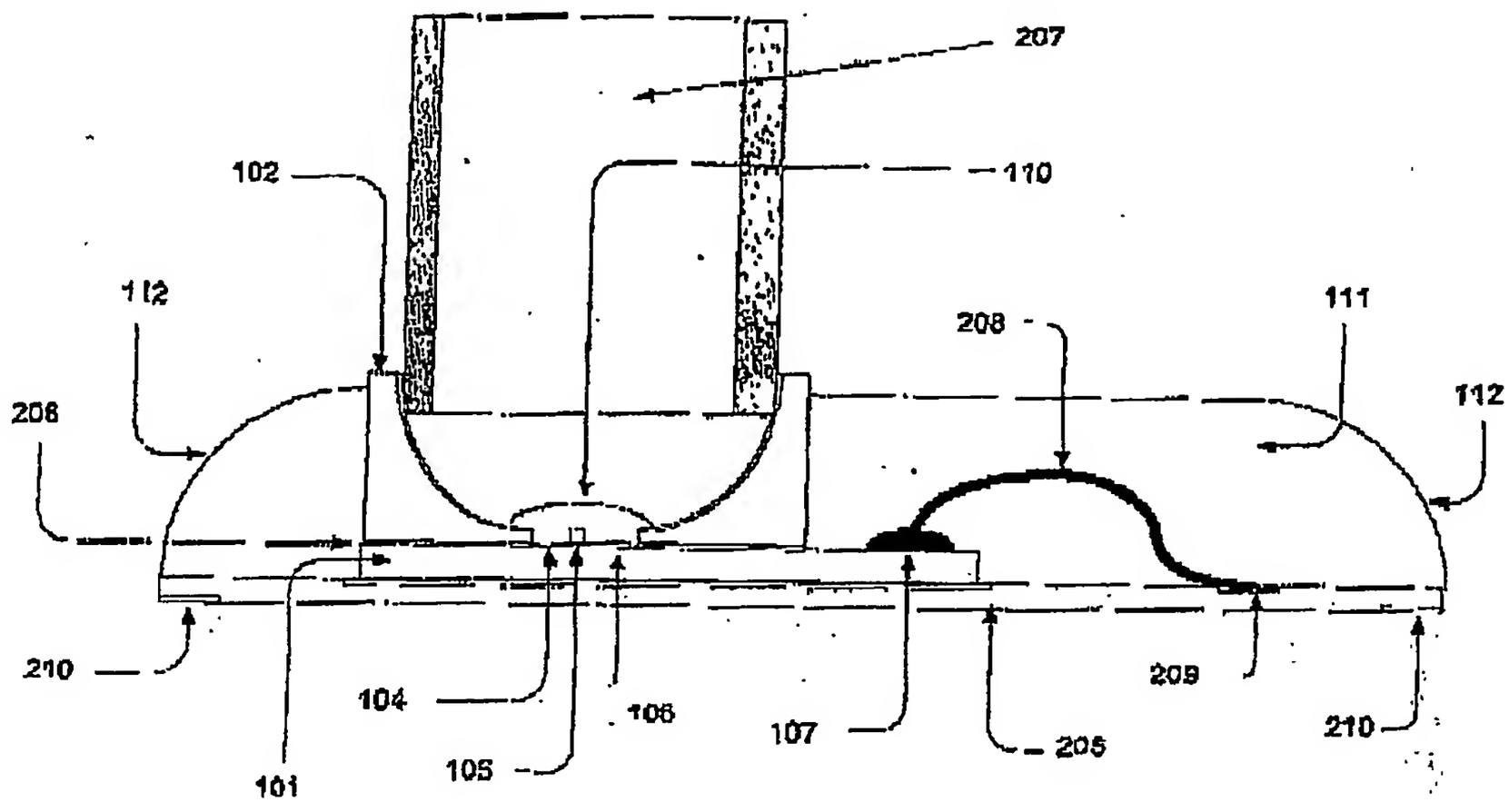
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Figure 2